Exhibit 1

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BEFORE THE ENVIRONMENTAL APPEALS BOARD
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C.

	)
In re:	)
Town of Newmarket	)
NPDES APPEAL No. 12-05	)
NPDES Permit No. NH0100196	)
	)

Declaration of Steven C. Chapra, Ph.D., F.ASCE[1]

Assessment of Whether the Department of Environmental Service's Approach to Nutrient Criteria Derivation for the Great Bay Estuary Used Reliable, Scientifically Defensible Methods to Derive Numeric Nutrient Criteria

Executive Summary

This document provides an expert review of the New Hampshire Department of Environmental Services (DES) approach to nutrient criteria development for the Great Bay Estuary. The methodologies under review are those presented in the document entitled "Numeric Nutrient Criteria for the Great Bay Estuary" (2009). My analysis is specifically directed at addressing whether the Division's use (and EPA's acceptance) of the "stressor-response" methodology in that document to derive the recommended nutrient criteria for total nitrogen employed scientifically defensible methods and whether those methods, as applied, are consistent with generally accepted scientific norms applicable to the use of such statistical methods. Upon review, it is my opinion that the DES criteria document did not use scientifically defensible methods and it failed to apply stressor-response methods in a manner accepted by the scientific community. *The methods applied are, in fact, grossly incorrect, internally inconsistent and have produced results that bear no reasonable relationship to reality.* Consequently, the analysis was fundamentally flawed and the proposed TN criterion of 0.3 mg/l is not demonstrated to be either necessary or appropriate to protect aquatic resources in the Estuary.

[1] Professor and Berger Chair in Computing and Engineering; Civil and Environmental Engineering Department; Tufts University; Medford, MA 02155

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Assessment of whether the 2009 Numeric Nutrient Criteria document employed scientifically defensible methods in criteria derivation

The DES numeric criteria document (hereafter, the "Criteria Document") was completed in June 2009[2] and relied extensively on simple linear regression analyses (1) to show nitrogen was causing certain adverse system responses and (2) to select the level of nitrogen that would control and eliminate those adverse responses. The adverse responses of concern were (1) low dissolved oxygen (D.O.) occurring in the tidal rivers and (2) poor water column transparency caused by excessive algal (phytoplankton) growth. The document also included limited references to excessive macroalgae growth for Great Bay proper, but this concern did not control the derivation of the recommended TN criteria for either the tidal rivers or the bay systems.

Figure 2 from the Criteria Document, presented below, indicates the scope of the monitoring program used to supply the data in the regression analyses. The various locations are physically very heterogeneous and include near ocean bays, tidal straights, inland bays, and tidal rivers.

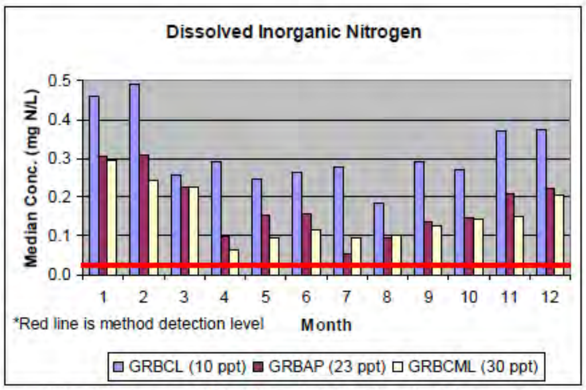
Figure 2: Trend Monitoring Stations for Water Quality in the Great Bay Estuary

Data from these various locations throughout the estuary, representing dramatically different physical habitats and hydrodynamic conditions, were averaged for use in subsequent regression analyses. Charts were prepared claiming to demonstrate how key nutrient concentrations and response variables (e.g., chlorophyll a, transparency) changed

[2] Numeric Nutrient Criteria for the Great Bay Estuary. New Hampshire Department of Environmental Services. June 2009.

through the system as a function of each other. Figure 8 from the Criteria Document illustrates monthly changes in inorganic nitrogen levels for a tidal river (Station GRBCL; Squamscott River), an inland bay (Station BRBAP; Great Bay-Adams Point), and the mouth of the estuary (Station BRBCML). The figure shows that inorganic nitrogen concentrations are significantly higher in the tidal river and decrease towards the mouth of the estuary. This decrease generally aligns with the average salinity at each station.

Figure 8: Seasonal Pattern for Dissolved Inorganic Nitrogen at Trend Stations with Different Salinities



All available data for these stations in 2000 - 2008 were included in this graph, which amounts to:
GRBAP: (Jan-Mar) 2000, 2001, 2006, 2007, 2008; (Apr-Dec) 2000 through 2008
GRBCL: (Jan-Mar) 2000, 2001; (Apr-Dec) 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008
GRBCML: (Jan-Mar) 2001; (Apr-Dec) 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008

Figure 13 from the Criteria Document illustrates the long term algal levels at various sites within the estuary, while Figure 16 illustrates monthly changes in median chlorophyll-a in a tidal river (Squamscott), Great Bay, and at the mouth. The long term average algal levels are higher in certain tidal rivers (e.g., Squamscott) but lower as one proceeds into waters with greater flushing characteristics (Great Bay and the Piscataqua River). It should be noted that the algal levels occurring throughout the system are, on average, generally quite low. Even in the higher detention time areas of Great Bay, the average concentration is only about 3 µg/l while in areas of very high tidal exchange (Piscataqua River) the average concentration ranges from 1-2 µg/l. This low level of primary productivity indicates that this system is not conducive to producing significant algal growth as a result of current nutrient inputs. [3]

[3] For example, a 100 µgN/L level of dissolved inorganic nitrogen in Great Bay has the potential to grow about 30 µg/L chlorophyll-a. This is an absolute upper limit as is borne out by the fact that the median algal growth in Great Bay is one tenth of this potential. This indicates that other factors (i.e., water column transparency, detention time, nutrient recycle, etc.) are controlling the amount of plant growth that occurs.

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Figure 13: 90th Percentile Concentrations of Chlorophyll-a in Regions of the Great Bay Estuary Calculated from Samples Collected in All Seasons in 2000-2008

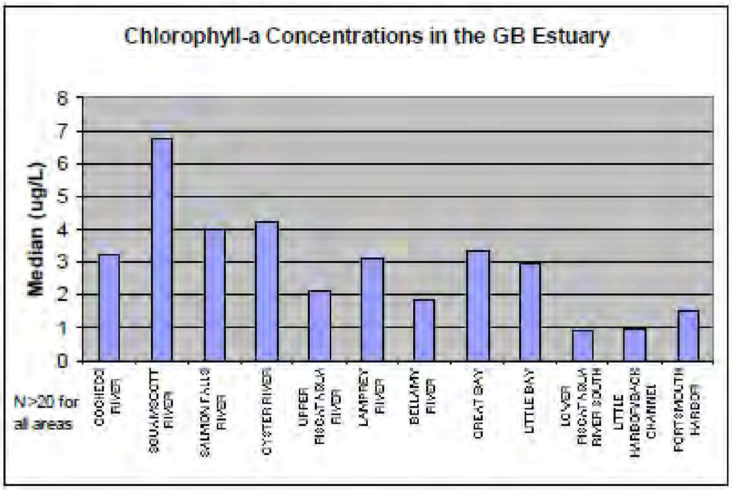
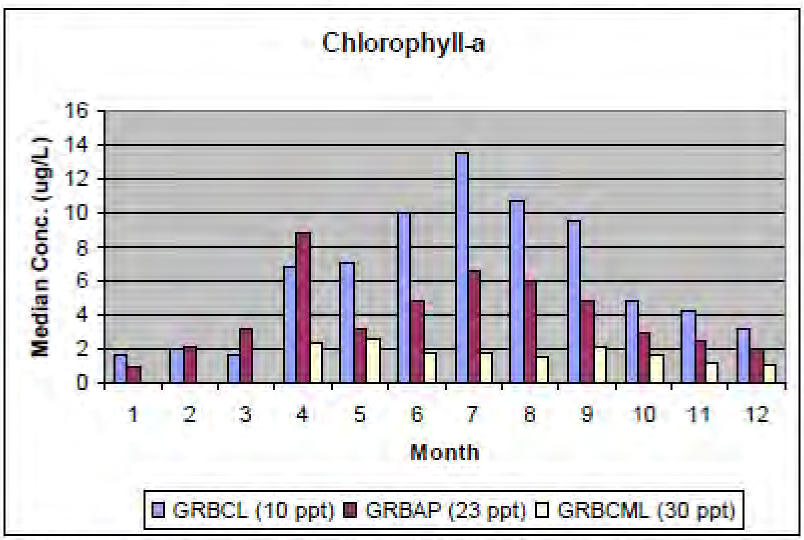


Figure 16: Seasonal Patterns of Chlorophyll-a at Trend Monitoring Stations with Different Salinities



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GRBAP: (Jan-Mar) 2000, 2001, 2006, 2007, 2008; (Apr-Dec) 2000 through 2008
GRBCL: (Jan-Mar) 2000, 2001; (Apr-Dec) 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008
GRBCML: (Jan-Mar) None; (Apr-Dec) 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008

The DES considered this information and concluded that the observed algal chlorophyll-a was in response to the spatial pattern of nitrogen. DES then prepared a regression analysis relating the 90th percentile chlorophyll-a concentration to total nitrogen (Figure 17 from the Criteria Document). It then claimed that this regression proves that primary productivity (as indicated by phytoplankton blooms) is associated with the concentration of nitrogen. [4]

[4] This conclusion was directly at odds with the 2013 State of the Estuaries report that confirmed algal levels in the system have not materially changed over a 30 year period despite wide fluctuations in available inorganic nitrogen. This would only occur if TN was NOT the factor presently limiting algal growth in this system.

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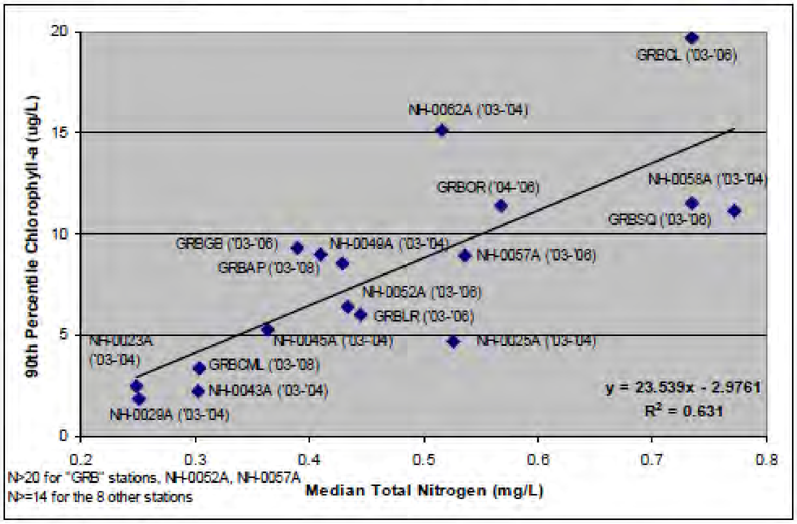
Figure 17: Relationship between Nitrogen and Chlorophyll-a Concentrations at Trend Stations



This regression does not provide any of the “proof” claimed by DES, and as discussed below, has gross methodological flaws. For a regression analysis to be scientifically defensible, confounding factors that influence the response variable (chlorophyll-a) must be controlled so that the stressor variable (total nitrogen) is the only factor (or at least the primary factor) influencing the response. DES did not considered any confounding factors when it prepared this simple regression. Consequently, all that can be determined from this analysis is that chlorophyll-a levels and total nitrogen levels co-vary. Such omission of confounding factors leads to what are formally called in the statistics literature “spurious correlations.”[5]

If the data are re-plotted and classified according to biotype it is readily apparent that the observed light attenuation response reflects the hydrologic conditions of the monitoring station. The apparent relationship between light attenuation and TN is an artifact caused by the concurrent decrease in TN concentration caused by dilution with the tides. Virtually all of the regression evaluations presented in the Criteria Document plot data from highly different systems (riverine, bay, ocean) without accounting for the many factors that make these systems respond differently. Such evaluations are not scientifically defensible, are not accepted within the scientific community and yield unreliable results.

[5] Pearl, J. 2000. Causality: Models, Reasoning and Inference, Cambridge University Press.

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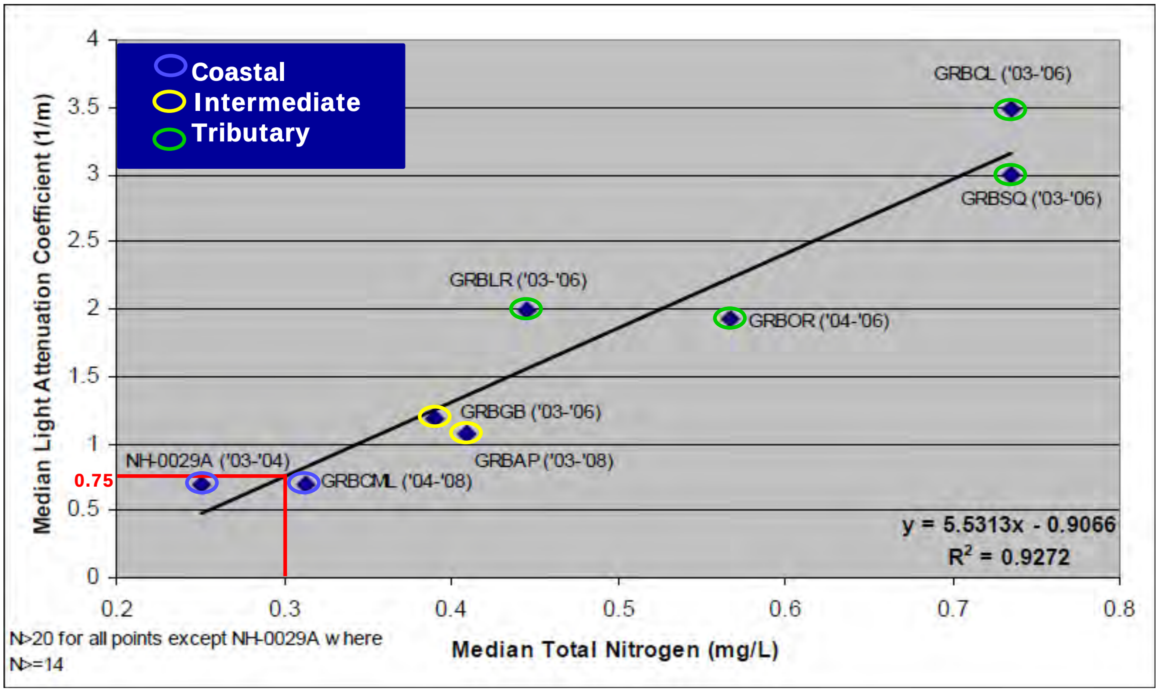

Dissolved Oxygen Impact Analyses

The Criteria Document presented several simple regressions relating dissolved oxygen levels to chlorophyll-a concentration (Figure 26) and total nitrogen (Figure 29). In Figure 26, the minimum and maximum reported dissolved oxygen concentrations are plotted against the 90th percentile concentration of chlorophyll-a in the various Assessment Zones of the estuary. The Criteria Document claims that these regressions clearly show both a decrease in the minimum D.O. and an increase in the maximum D.O. with increasing chlorophyll-a.[6] This regression evaluation is unreliable for several reasons. First, as with other graphs, it combines results from hydrologically distinct areas, which has no basis in proper ecological data assessment. Many factors influence D.O. and it is certain that these factors are not uniform among all of the assessment zones and seasonal data (e.g., temperature, salinity, time of sampling). Secondly, the supposed influence of algal level on minimum D.O. yields a very flat response, confirming that nutrients cannot be the primary factor influencing the response. Consequently, nutrient control cannot materially improve water quality with regard to attainment of the D.O. criterion. Finally, Figure 26 implies that the diurnal range in D.O. varies from 7 – 12 mg/L for chlorophyll-a ranging from 2 – 17 µg/L. Modeling estimates using well calibrated models predict a diurnal D.O. range of only 1 – 3 mg/L for such a narrow range of algal growth. Consequently, some other unconsidered factors must contribute significantly to the observed results, not TN.

[6] It is not apparent that this graph is even plotting the D.O. condition occurring when the 90th percentile chlorophyll-a concentrations occurs. If this is the case, the entire relationship is a statistical fabrication based on unrelated information.

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Figure 26: Relationship between Dissolved Oxygen and Chlorophyll-a in Assessment Zones

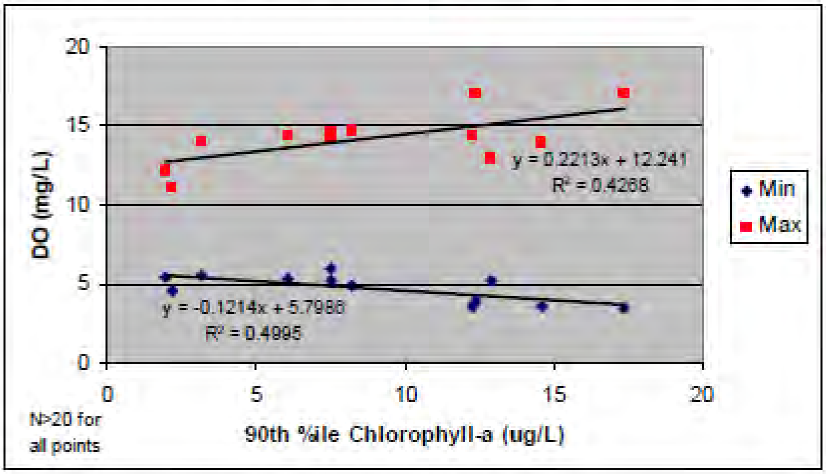

Figure 29 presents minimum dissolved oxygen at the Trend Stations in relation to median total nitrogen. This type of analysis has no basis in the literature or any published method of acceptable DO impact assessment. TN does not have a direct effect on dissolved oxygen and attempting to relate these two parameters is not accepted within the scientific community. Rather, DES must first show the relationship between TN and chlorophyll-a and then show the relationship between chlorophyll-a and D.O. If this is done by comparing Figure 17 and Figure 26, it shows a very minor influence of TN on minimum D.O. However, the regression in Figure 29 suggests a very significant influence of total nitrogen on minimum D.O. This discrepancy is a clear indication that these regression analysis are producing diametrically opposed results.

Figure 29: Relationship between Dissolved Oxygen and Nitrogen at Trend Stations

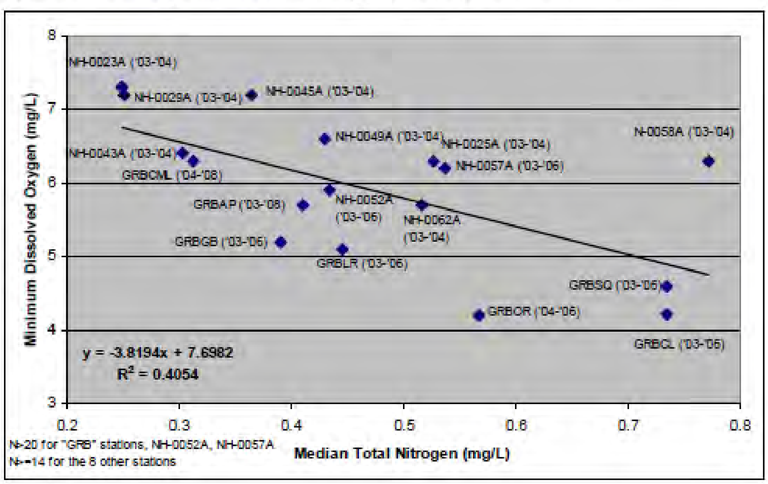

Figure 39 from the Criteria Document presents a regression of the measured light attenuation coefficient versus median total nitrogen at the Trend Stations. Based on this regression analysis, and targeting light penetration depth to support eelgrass populations, DES established a TN criterion of 0.3 mg/L. As with the other regressions, light attenuation is influenced by many other factors (e.g., color, turbidity) that were not

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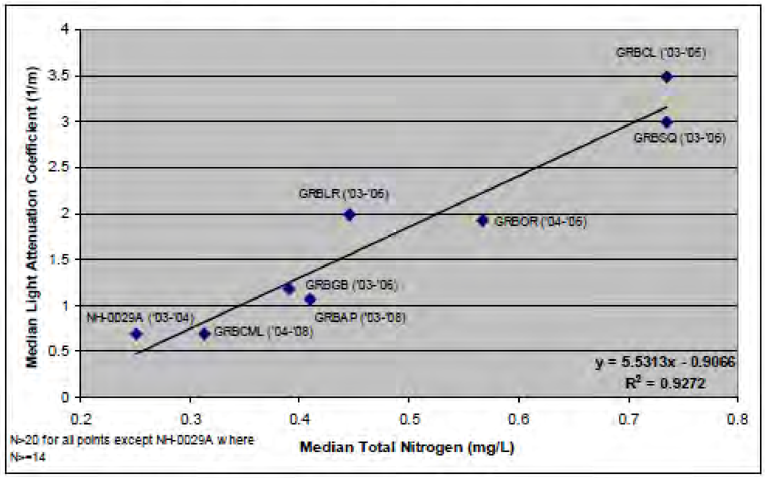
considered when the data for all the Trend Stations were pooled to develop the regression. As a result, the analysis is not scientifically defensible. However, other data are available to confirm that this regression is only an artifact of the analysis. The data presented in Figure 13 show that median algal levels vary from about 1 – 7 µg/L through the system. These concentrations cannot physically cause the change in transparency suggested in Figure 39. Moreover, an independent study on the factors influencing transparency determined that chlorophyll-a is only a minor factor. (Morrison et al. 2008) Therefore, TN cannot cause the change in transparency presented in Figure 39.

Figure 39: Relationship between Light Attenuation Coefficient and Total Nitrogen at Trend Stations



The fundamental errors common to all of these analyses are:

1. The analyses combine data sets from greatly different physical settings; this is a simply not acceptable.
2. The predicted impacts from algal growth on transparency and DO are physically impossible, but that reality was not recognized by the document author.
3. None of the co-varying or confounding factors that must be considered to allow such regression analyses to produce reliable results were conducted.
4. The results are directly at odds with published State of the Estuary reports and tributary assessments confirming that TN has not caused material changes in algal growth nor is it controlling minimum DO, verifying these analyses have no connection to reality in this system.

The Criteria Document discusses the work of Morrison et al., 2008 (at 61) which confirmed that algal growth was a minor component affecting system transparency – as would be expected given the low algal growth in the system. That analysis confirmed that color from the tidal rivers was the main factor limiting light throughout the system. Color is NOT a factor influenced by the total nitrogen inputs to the system but is a natural condition occurring in certain watersheds throughout the country. The steady improvement in transparency through this system is most readily explained by dilution of color inputs from the tidal rivers – not any TN influence on excessive algal growth.

Likewise, with respect to system D.O., the Criteria Document (at 51) indicates that low D.O. in the Lamprey River is documented to be caused by the system hydrodynamics. However, this factor is nowhere assessed in any of the D.O.-related evaluations. Thus, it is clear that the report's conclusions based on these graphs are not scientifically defensible and fail to conform to even basic principles of environmental data analysis (i.e., to draw inferences from ecological responses to pollutants (such as nutrients), causal relationships and confounding factors must be identified and controlled in the assessment). This is a strict requirement to ensure that the analysis does not become confounded by factors unrelated to the variable of concern.[7]

Where complex and second order effects are involved, which may be controlled by a host of factors unrelated to nutrients (such as transparency and dissolved oxygen), the analysis must account for the other factors to demonstrate that the parameter of concern (in this case nutrients) is the parameter controlling the system response. No treatise accepts the position that it is proper to plot TN or chlorophyll a versus an instream D.O. concentration or measurement of transparency to demonstrate a scientifically defensible causal relationship. D.O., in particular, is easily affected by a dozen chemical, physical and biological factors that interact to cause a particular response.[8] Algal growth may affect dissolved oxygen via two routes: (1) diurnal changes due to plant photosynthesis and respiration and (2) creation of additional oxygen demand through cell death (e.g., sediment oxygen demand or "SOD"). However, neither of these factors are assessed. At a minimum, measurements of SOD could have confirmed whether algal growth is having any significant effect on this component. Likewise, transparency is controlled by four main factors: water, color, non-algal turbidity, and algal growth. There is no direct relationship between TN and transparency. Any regression showing such a relationship must first demonstrate the connection between transparency and chlorophyll-a, but no such relationship was provided in the Criteria Document.

Unless this is confirmed and quantified, the other factors known to be changing between the locations due to system hydrodynamics and differing external inputs could completely explain these graphs.[9] Such a sub-system response analysis would have provided the necessary level of confirmation that reducing TN levels will have a

[7] It is a basic principle of environmental assessment and water quality criteria development that tests and evaluations are run under stable (steady state) conditions to ensure that the effect of the parameter of concern, and not some other changing variable, is occurring. The graph present a vision of "single parameter ecology" which is a uniformly rejected theory of data and ecological impact assessment.

[8] Thomann, R.V., Mueller, J. A. 1987. Principles of Surface Water Quality Modeling and Control. Harper-Collins; Chapra, S.C. 1997. Surface Water Quality Modeling, McGraw-Hill.

[9] HydroQual (2012) demonstrated that algal levels in the Squamscott River were heavily influenced by the discharge of algae from the Exeter lagoon system. The average impact on algal levels was approximately 6 μg/l. Since these algae do not grow in the system, it was totally inappropriate to plot data from the Squamscott River along with other tidal river algal levels and attribute those changes to TN inputs. As shown in Figure 16 (average monthly chlorophyll a levels for three system locations) the average algal in the Squamscott River (at Chapman's landing) ranges from 10- 14 μg/l June to September. Approximately 50% of this algal growth appears to be an artifact of the Exeter discharge. Eliminating this artifact would have resulted in a graph demonstrating little difference in algal growth between this tidal river and Adams Point in Great Bay. This would likely have had an even greater impact on Figure 17 given the importance of the Squamscott River data to the regression line.

demonstrable benefit to improving D.O. and transparency. At this point, the only thing that this analysis demonstrates is that as one moves from the tidal rivers to the ocean, minimum D.O. levels increase and transparency improves. That is a thoroughly unremarkable finding that would apply to almost any estuarine system since transparency is typically better and D.O. concentrations less variable in the ocean but poorer (often naturally) in the tidal rivers due to marsh and other watershed/system hydrodynamic influences.

In summary the analysis presented in the document entitled "Numeric Nutrient Criteria for the Great Bay Estuary" (2009) are (1) not based on methods generally accepted by the scientific community, (2) are contrary to the methods published in dozens of treatises on this topic (3) utilize obviously incorrect and physically impossible relationships attributed to algal growth and nitrogen influences and (4) are so thoroughly confounded and unexplained as to render them worthless for the purposes of numeric nutrient criteria development.

Acceptable Scientific Methods Governing Use and Application of Stressor-Response Methodologies

The following provides additional information regarding the degree of analysis necessary to allow this type of "stressor-response" assessment to be considered scientifically defensible and useful in nutrient criteria development.

The proper use of statistical methods to develop scientifically defensible nutrient criteria has been a highly controversial subject. In 2008, EPA began to apply regression analyses in an effort to set nutrient endpoints for use in TMDLs in lieu of site-specific modeling evaluations. At that time, I participated in an effort to get these methods reviewed by EPA's Science Advisory Board.

In August 2009, EPA released a draft Guidance document on use of the "stressor – response" approach to derive numeric nutrient criteria that recommended simply plotting the nutrient level versus various ecological endpoints (e.g., macroinvertebrate indices) under the assumption that the nutrients present in the water column were the cause of the change in the response variable (e.g., invertebrate index).[10] The fundamental scientific error impacting the validity and scientific reliability of this approach was that it presumed, rather than demonstrated "cause and effect." It is widely understood in the scientific community that response variables such as invertebrate indices and chlorophyll a level are impacted by a broad range of factors that may co-vary with nutrient levels. Moreover, as nutrients themselves are not toxics, one would, in general, need to first demonstrate that the nutrient level caused some change in plant growth that then caused a change in habitat and other water quality factors. This fact is reflected in an example "mechanisms" diagram contained in EPA's final stressor-response guidance, below.

[10] Empirical Approaches for Nutrient Criteria Derivation (Science Advisory Board Review Draft) USEPA August 17, 2009.

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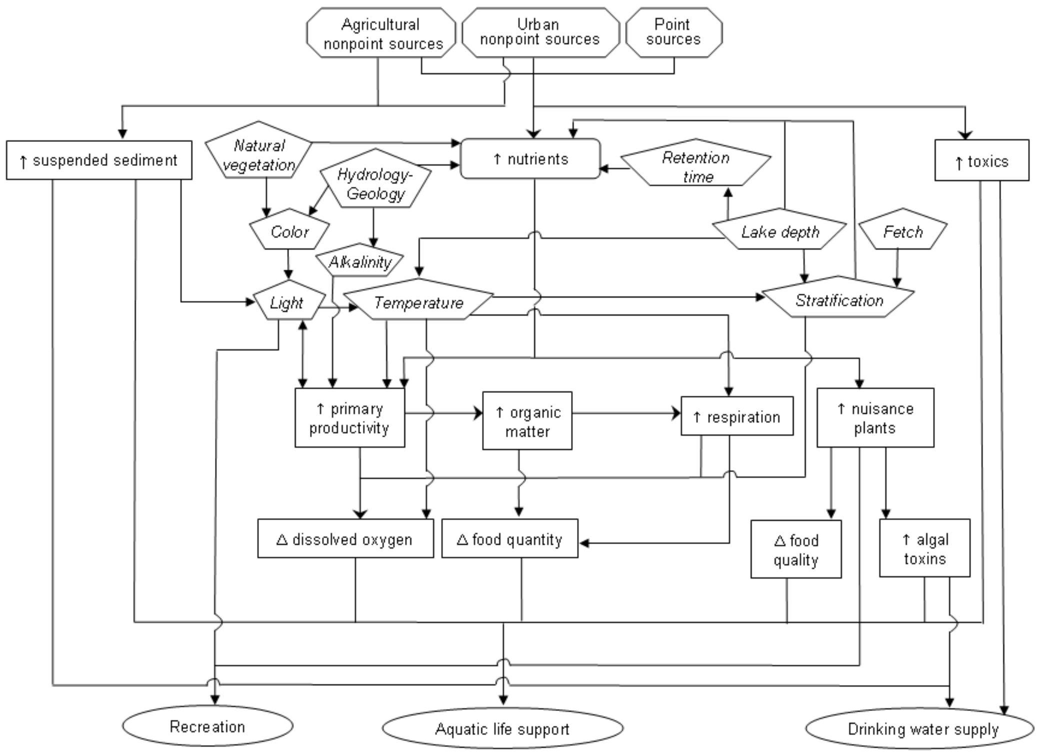

EPA 2010 Stressor-Response Guidance at 10

Due to the numerous technical concerns voiced over developing nutrient criteria using these simplified methods, EPA used its Science Advisory Board (SAB) to conduct an independent peer review in September 2009 (three months after the 2009 Numeric Nutrient Criteria document was finalized by New Hampshire DES). Expert's from across the country were brought together to hear testimony and review the validity of EPA's approach. The SAB review clearly determined that the use of these methods for nutrient criteria development were not "scientifically defensible" <u>unless</u> major revisions and restrictions were incorporated to ensure that the statistical relationships reasonably reflected what was actually occurring in the receiving water.[11] In any event, the SAB determined that EPA's recommended approach to employing various simplified regression approaches to predict complex ecological response to nutrients were not scientifically defensible for a series of reasons including:

- The methods do not demonstrate "cause and effect";
- The methods failed to consider confounding and co-varying factors such as habitat and physical/chemical differences independently affecting the response variables;
- The methods failed to address first-order impacts (plant growth) that must precede any more complex impacts; and
- The statistical methods, by themselves, do not verify that the changes in condition

[11] SAB Ecological Processes and Effects Committee, April 27, 2010 Final – Review of Empirical Approaches for Nutrient Criteria Derivation.

are biologically significant.

In response to these criticisms, EPA significantly revised the draft stressor-response document and republished the methods in November 2010.[12] That document largely reflected the technical recommendations of the Science Advisory Board. Most importantly, EPA's final document specified that the methods would only be considered sufficient if data are available on "causal variables, response variables and confounding factors" (EPA Guidance @ 4). Absent such information, a "scientifically defensible' relationship generally cannot be developed. Ensuring that data are properly "classified" is a key factor for ensuring the evaluated relationship reflects nutrient impacts and is not unduly impacted by other changing ecological (confounding or co-varying) conditions (EPA Guidance @ 55, 56) Consequently, EPA notes that "many confounding factors must be considered when estimating the effects of nitrogen/phosphorus on a measure of aquatic life in streams (e.g., macroinvertebrate index)." (EPA Guidance @ 11) This concept applies also to endpoints such as D.O. and transparency that are not directly influenced by nutrients. Consequently, EPA includes extensive discussion on the importance of properly conducting the "confounding factors" analysis and further indicates that when parameters co-vary (such as nutrients, color, turbidity, solids, algal levels) it is critical to determine which parameter is actually controlling the response variable. (EPA Guidance @ 26-29).

The following quotes from EPA's guidance document further illustrate the methodology that must be used and factors that must be considered to ensure a "stressor-response" assessment is scientifically defensible:

Recommendations from 2010 USEPA Stressor-Response Guidance

Need to ensure Data Evaluation is Only Conducted for Similar Ecological Settings

[I]n the first step of the analysis, classification, the analyst attempts to control for the possible effects of other environmental variables by identifying classes of waterbodies that have similar characteristics and are expected to have similar stressor-response relationships. Classifications for a stressor-response analysis are typically based on statistical analysis; however, existing classes can be used as a starting point. The most widely used existing classification for analyses of nutrient data are the fourteen national nutrient ecoregions.

(EPA Stressor-Response Guidance at 32)

Classifying data is a key step in analyses of stressor-response relationships because the expected responses of aquatic ecosystems to increased N and P can vary substantially across different sites.

(EPA Stressor-Response Guidance at 55)

[12] Using Stressor response Relationships to Derive Numeric Nutrient Criteria, USEPA November 2010.

> The first step for classifying data is to identify variables to include in the analysis that will help improve the accuracy and precision of estimated stressor-response relationships.
>
> * * * * *
>
> [E]xploratory data analysis can indicate other variables that should be included in the classification analysis. In particular, other variables that are strongly correlated with the stressor variable or with the response variable should be evaluated for inclusion in classification analysis.
>
> (EPA Stressor-Response Guidance at 56 – 57)

The Impact of Confounding and Co-varying Factors Must be Assessed

> [M]any confounding variables must be considered when estimating the effects of nitrogen/phosphorus pollution on a measure of aquatic life in streams (e.g., a macroinvertebrate index).
>
> (EPA Stressor-Response Guidance[13] at 11)
>
> [W]hen the effects of a possible confounder are not controlled, the relationship estimated between the nutrient variable and the response variable may partially reflect the unmodeled effect of the confounding variable.
>
> (EPA Stressor-Response Guidance at 65)
>
> The possible influences of confounding factors are the main determinants of whether a statistical relationship estimated between two variables is a sufficiently accurate representation of the true underlying relationship between the two variables. …
>
> Before finalizing candidate criteria based on stressor-response relationships, one should systematically evaluate the scientific defensibility of the estimated relationships and the criteria derived from those relationships. More specifically, one should consider whether estimated relationships accurately represent known relationships between stressors and responses and whether estimated relationships are precise enough to inform decisions.
>
> (EPA Stressor-Response Guidance at 65)
>
> Beyond the possible effects of confounding variables, one should also consider whether assumptions inherent in the chosen statistical model are supported by the data.
>
> (EPA Stressor-Response Guidance at 67)

The 2009 Numeric Nutrient Criteria document clearly did not meet any of these pre-requisites for applying simple linear regression analysis in the development of numeric

[13] EPA. November 2010. Using Stressor-response Relationships to Derive Numeric Nutrient Criteria. EPA-820-S-10-001.

nutrient criteria. The findings presented in the Criteria Document are based on procedures that the SAB rejected, which is not surprising given the timing of its development (pre SAB).

A cursory review of the 2009 Numeric Nutrient Criteria Document confirms that is did not rely on accepted, scientifically defensible methods. The evaluation errors were extensive and included virtually every major factor that EPA has identified in its final Stressor-Response guidance document, including:

- Combining data from different biotypes that affect D.O. and transparency;
- Failing to consider co-varying pollutants and parameters;
- Failing to evaluate key confounding factors;
- Presuming that the pollutant was the cause of the changing system response parameter when the available data confirmed it was not; and,
- Failing to assess the accuracy and reliability of the suggested relationships based on data and studies from specific areas within the Great Bay system.

Is the Department's use of simplified regression methods scientifically defensible and consistent with accepted scientific methods?

The short answer is clearly - no. The key to the proper/defensible use of the stressor-response methods lies in addressing the factors that could otherwise explain the relationship being assessed. Since both DO and transparency are affected by numerous ecological, chemical and biological factors, any valid defensible assessment must reasonably account for these factors, prior to reaching any conclusion that nutrients are the primary cause of changing transparency and D.O. in this system. Both the SAB and EPA itself have identified the prerequisites that must be met to utilize these methods to produce reliable and scientifically defensible results. The Department has plainly failed to address the confounding factors and similar system prerequisites and has simply ignored other admonitions contained in the SAB report and the applicable federal guidance regarding proper use of this method.

Moreover, as an expert in the field of environmental impacts and effects analysis, I am aware of no treatise that would support the position that an acceptable analysis may plot data from multiple habitat types with major hydrologic difference on the same graph in assessing complex ecological phenomena. Consequently, the estuary-wide nutrient criteria generated by using the approach described in the Department's technical report is not scientifically reliable, not scientifically defensible, not a method generally accepted within the scientific community and has produced a result that is, consequently, demonstrably incorrect.

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I swear that the forgoing statements are true to the best of my knowledge.

Steven C. Chapra, Ph.D., F.ASCE

STATE OF MASSACHUSETTS
COUNTY OF MIDDLESEX

Signed and sworn to before me on this 27TH day of February, 2013 by Steven C. Chapra.

Notary Public

My Commission Expires: August 10, 2018

(Notary Seal)

NANDI P. BYNOE
Notary Public
Commonwealth of Massachusetts
My Commission Expires
August 10, 2018

Notarized this Day, 27 FEB 2013